



# CAIT

Center for Advanced Infrastructure & Transportation  
Rutgers, The State University of New Jersey

NJDOT Bureau of Research  
QUARTERLY PROGRESS REPORT

Project Title:	Evaluation of Poisson's Ratio		
RFP NUMBER:	NJDOT RESEARCH PROJECT MANAGER: Mr. Anthony Chmiel		
TASK ORDER NUMBER/Study Number: Task Order No. 128 / 4-26531	PRINCIPAL INVESTIGATOR: Thomas Bennert		
Project Starting Date: 1/01/2004 <b>Original Project Ending Date: 12/31/2005</b> <b>Modified Completion Date: 12/31/2006</b>	Period Covered: 3 <sup>rd</sup> Quarter 2004		

Task	% of Total	% of Task this quarter	% of Task to date	% of Total Complete
Literature Search/Sensitivity Analysis	10%	50%	100%	10%
1. Material Collection	5%	0%	100%	5%
2. Laboratory Testing	70%	5%	45%	31.5%
3. Calibration	15%	5%	35%	5.25%
4. Reporting	10%	0%	0%	0%
Final Report				
TOTAL	100%			51.75%

Project Objectives:

- Conduct a sensitivity analysis to evaluate how the changing of the Poisson's Ratio affects the stresses and strains determined using elastic layer analysis procedures
- Evaluate the measurement of the Poisson's Ratio for aggregate base materials during the resilient modulus test and compare to available prediction equations
- Evaluate the measurement of the Poisson's Ratio for HMA materials during the dynamic modulus test and compare to available prediction equations

Project Abstract:

For the upcoming AASHTO Mechanistic Design Guide, the two main parameters needed for predicting the pavement stresses and strains are the modulus and the Poisson's Ratio. At the moment, the Poisson's Ratio is estimated based on the modulus of the material (both aggregate and HMA) or by the HMA temperature. However, this was developed using a minimal amount of material that does not represent the commonly used materials of New Jersey. Therefore, a research effort was developed to evaluate the current prediction methods and, if applicable, modify them to provide values that more closely represent materials from New Jersey.

1. Progress this quarter by task:

Twelve new samples were mixed, compacted, cored and cut to be tested under the dynamic modulus testing specification. The samples are comprised of a 12.5mm Superpave mix (on the coarse side) and utilize asphalt binders of PG64-22 and PG76-22, respectively. The samples were compacted to specifically evaluate the effect of air voids. Three samples of each mix were compacted to 2.5% (+/- 0.5%) and 7% (+/- 0.5%) air voids. The samples were tested under the guidelines of the Dynamic Modulus test, with an additional circumferential LVDT to determine the lateral strain during testing. Previous testing of a PG64-22 and PG76-22 at 4.0 (+/- 0.5%) indicated that predictive equation and the measured Poisson's ratio at low to moderate temperatures matched well. However, the predictive equation was found to over-predict the Poisson's ratio at high temperatures, especially for the PG76-22.

The results of the samples compacted to a high air void condition, 7% (+/- 0.5%), were shown to compare more favorably to the NCHRP predictive equation than the 4% samples. This may be due to the compacted air voids used in the NCHRP database from where the predictive equation was developed. Testing is currently being



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conducted on the low air voids, 2% (+/- 0.5%), and it is hopeful that the results will be available for presentation at the Quarterly meeting.

At the present time, it appears that a more accurate predictive equation may need to include a greater emphasis on the volumetric properties, especially air voids, and also binder stiffness. The current NCHRP predictive equation is based on the dynamic modulus,  $E^*$ , which is dependent on both the volumetric properties and the binder stiffness. Therefore, the impact of the aggregate gradation will also be included. Upon completion of the coarse graded HMA mix testing, a fine-graded HMA mix, using the same PG graded binders, will be evaluated under the identical compaction and testing conditions. This should provide a more comprehensive database to initiate a predictive equation for verification.

2. Proposed activities for next quarter by task:

Dynamic modulus testing, with an additional circumferential LVDT, will be conducted on low air void compacted HMA samples of a coarse-graded 12.5mm Superpave mix. After testing, a fine-graded 12.5mm Superpave mix will be compacted to similar air void ranges as the coarse-graded.

3. List of deliverables provided in this quarter by task (product date):

N.A.

4. Progress on Implementation and Training Activities:

N.A.

5. Problems/Proposed Solutions:

N.A.

Total Project Budget	\$426,111
<b>Modified Contract Amount:</b>	
Total Project Expenditure to date	\$200,806
% of Total Project Budget Expended	47%

\* These are approximate expended amounts for the project; these estimates are for reference only and should not be used for official accounting purposes. For a more accurate project accounting please review the quarterly invoice for this project.